

REPORT DOCUMENTATION PAGE

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MEMORANDUM FOR PRS (In-House Publication)

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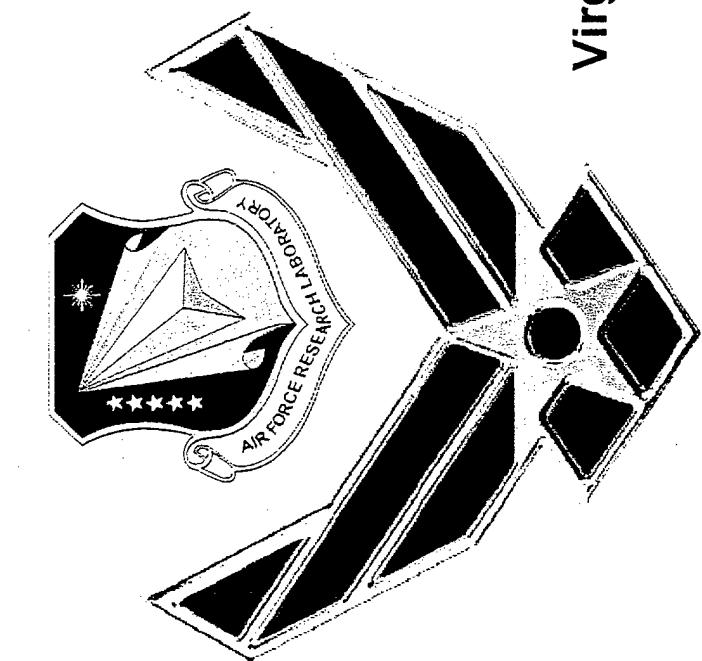
29 Oct 2001

SUBJECT: Authorization for Release of Technical Information, Control Number: AFRL-PR-ED-VG-2001-211
C.T. Liu (PRSM), C.W. Smith (Virginia Poly Inst.), "Near Tip Behavior in a Particulate Composite
Material Under Constant Strain Rates Including Temperature and Thickness Effects"

10th International Conf. on Fracture
(Hawaii, 3-7 Dec 2001) (Deadline: 23 Nov 01)

(Statement A)

NEAR TIP BEHAVIOR IN A PARTICULATE COMPOSITE MATERIAL UNDER CONSTANT STRAIN RATES INCLUDING TEMPERATURE AND THICKNESS EFFECTS



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NEAR TIP BEHAVIOR IN A PARTICULATE COMPOSITE MATERIAL UNDER CONSTANT STRAIN RATES INCLUDING TEMPERATURE AND THICKNESS EFFECTS

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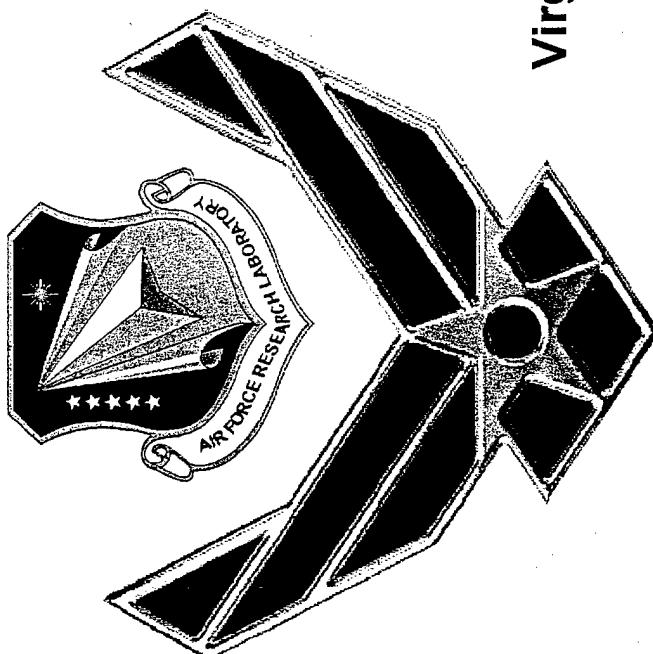
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Smith

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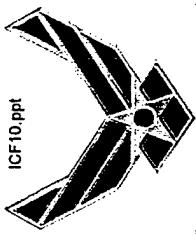
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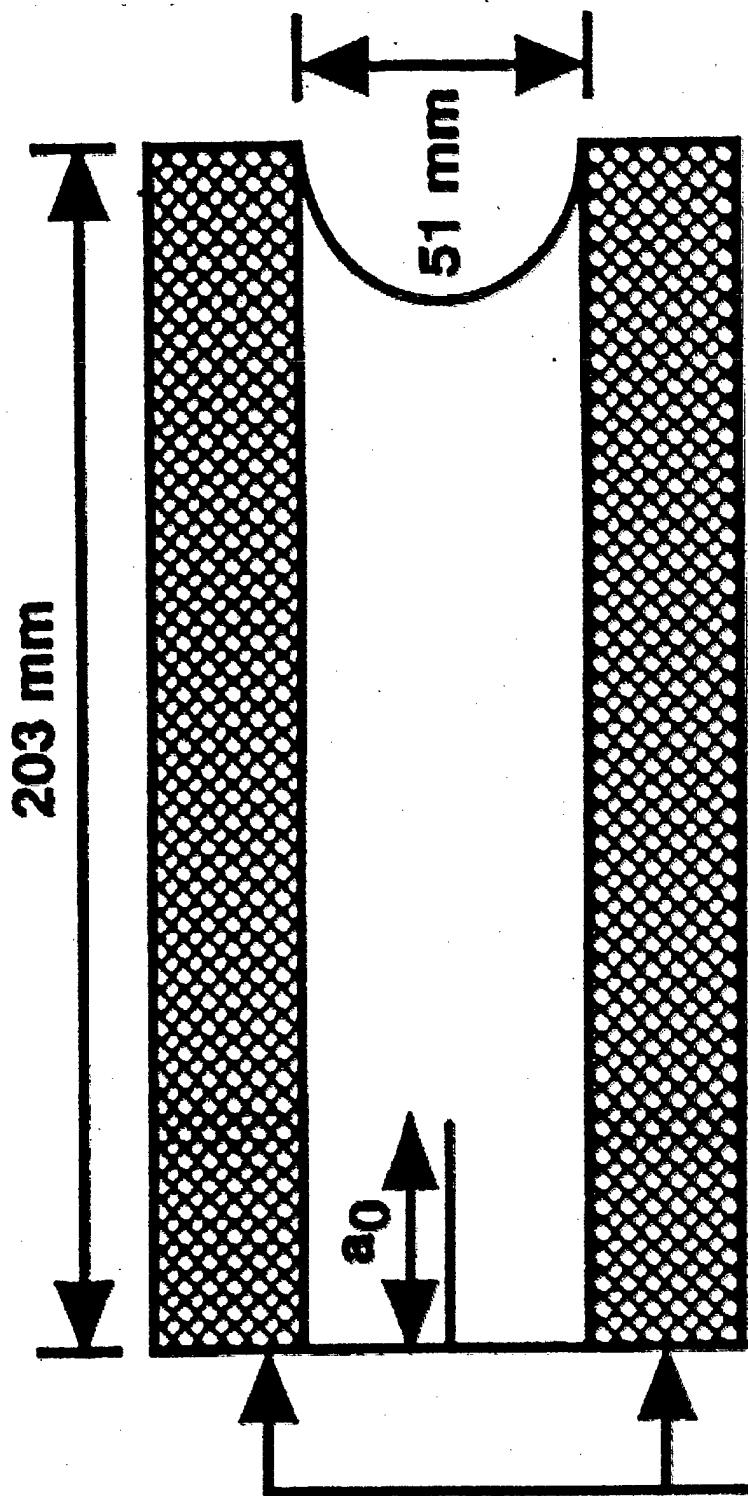
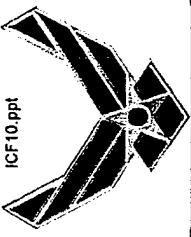


Objectives

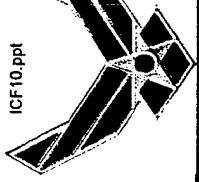
- Investigate the Effects of Temperature and Specimen Thickness on Local Strain Fields and Crack Growth Behavior in a Particulate Composite Material.
- Temperatures: -53.9°C, 22.2°C, and 73.9°C
- Specimen Thickness': 2.54 mm and 12.7 mm



Specimen Geometry



Aluminum grips cemented to specimen
Specimen thickness: 2.5 mm
 $a_0 = 2.5 \text{ mm}$

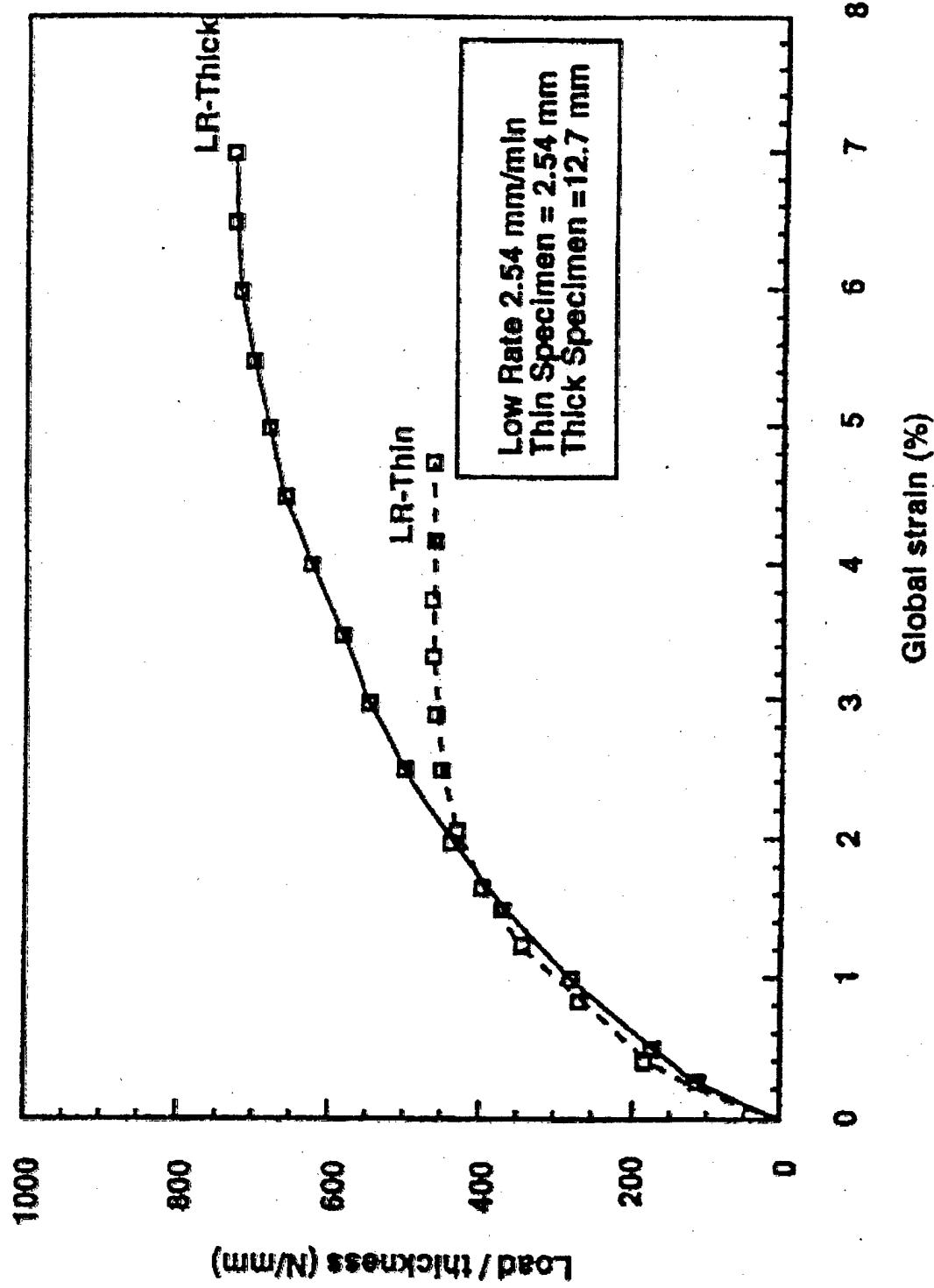


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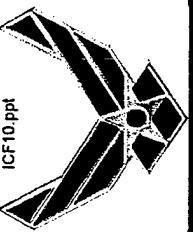
Load-Strain Relations ($T = -53.9^{\circ}\text{C}$)



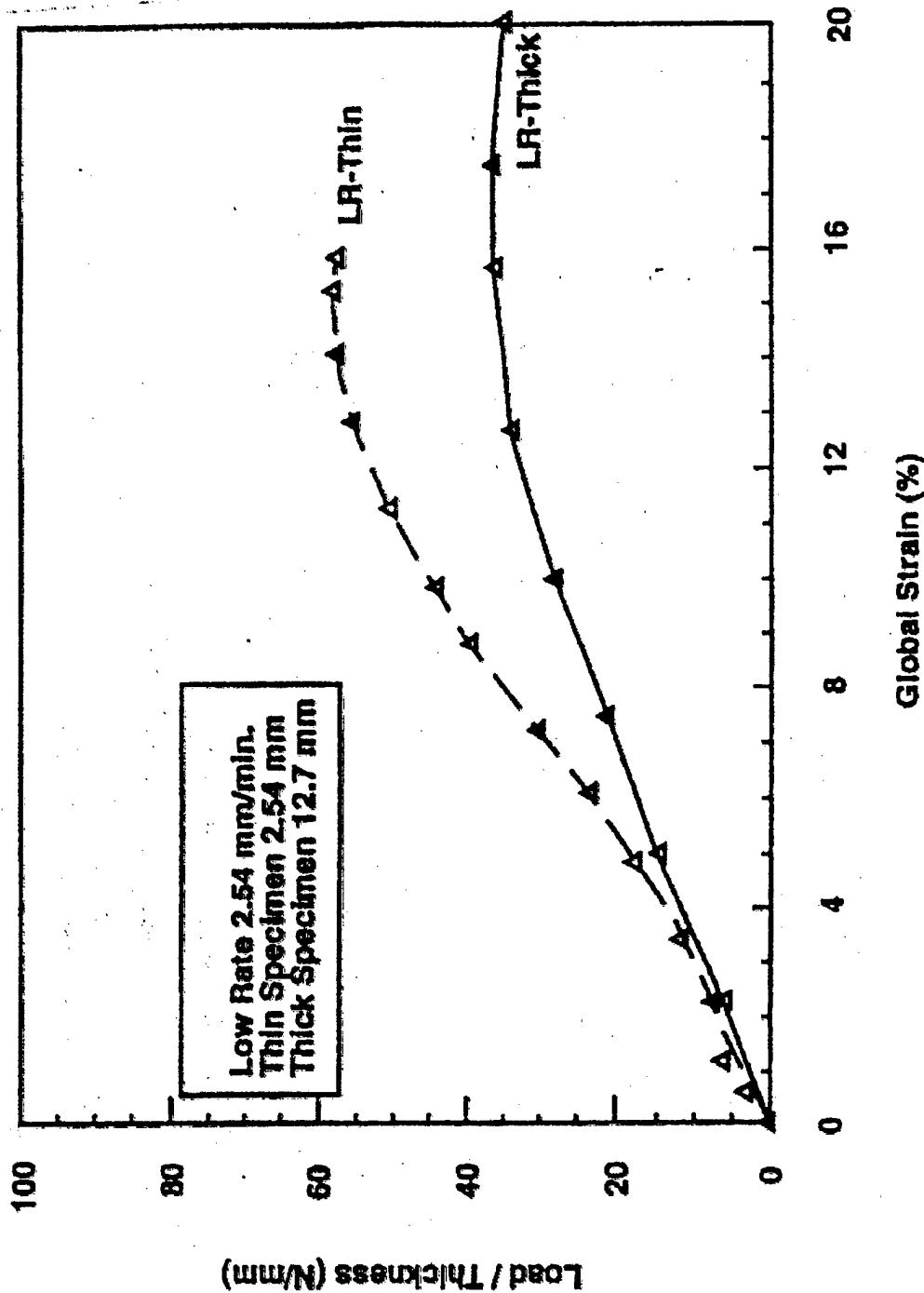
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Load-Strain Relations ($T=73.9^{\circ}\text{C}$)

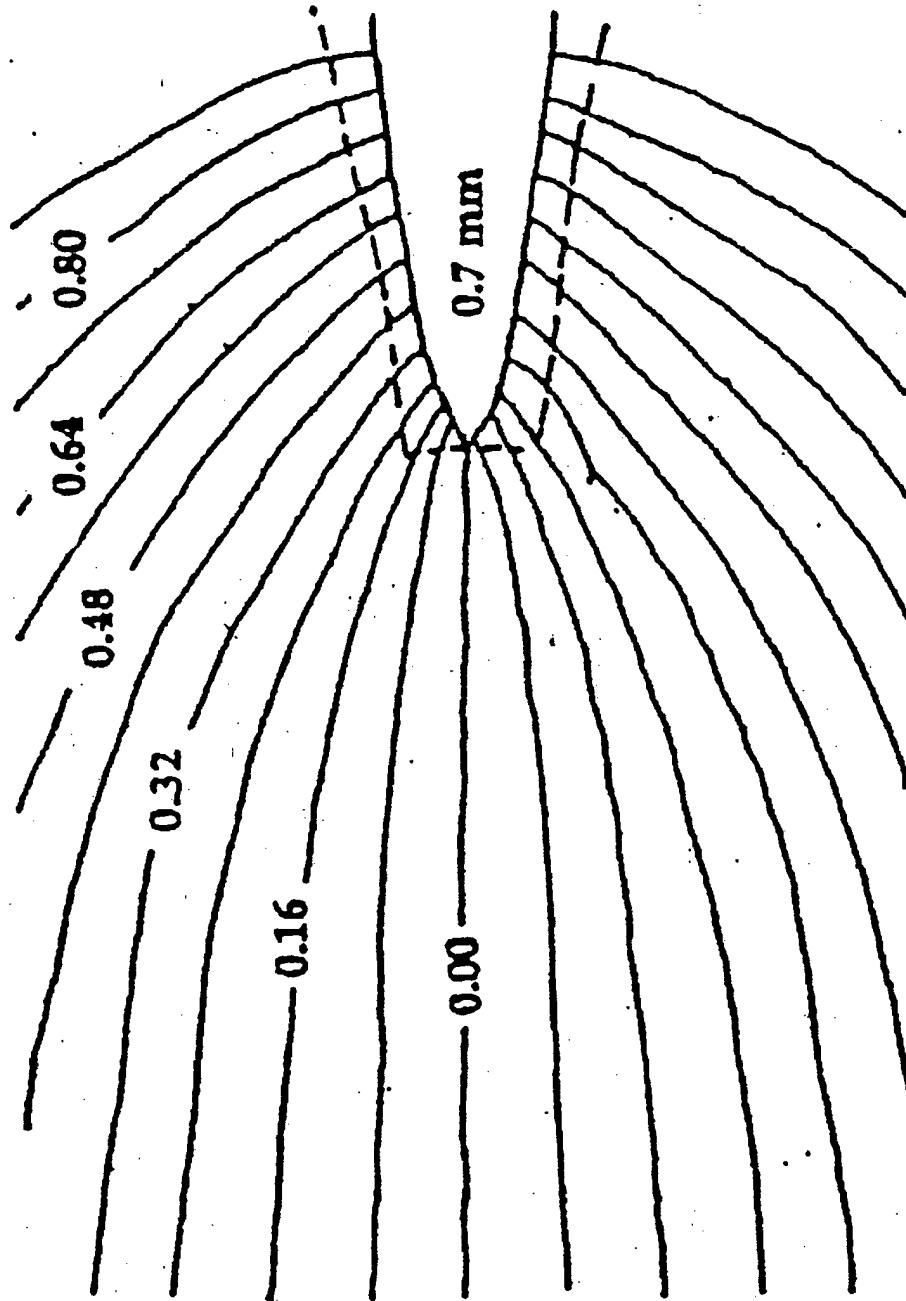
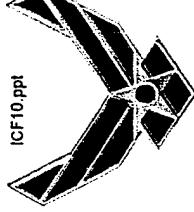


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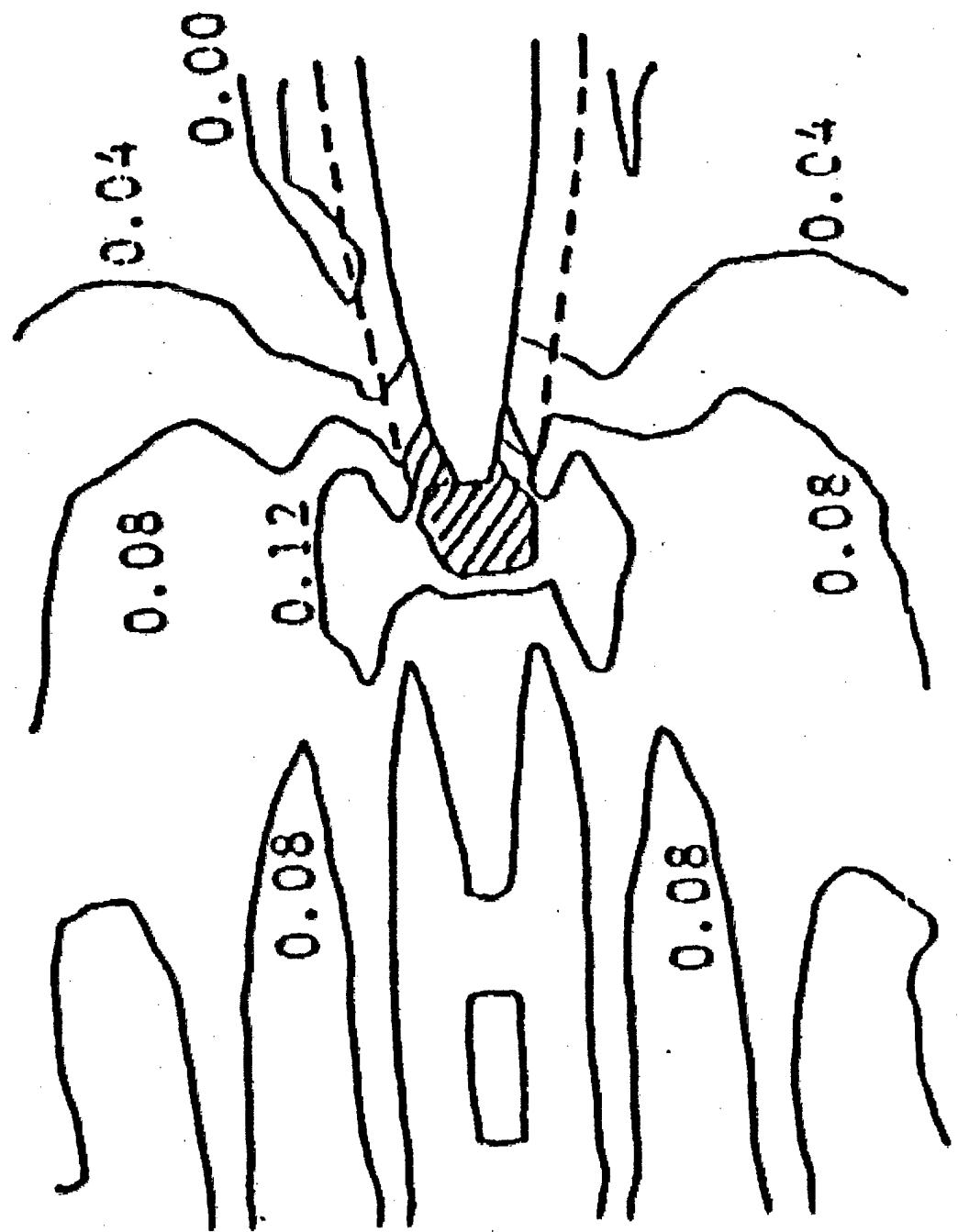




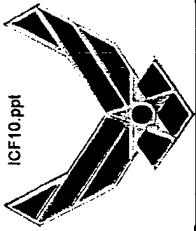
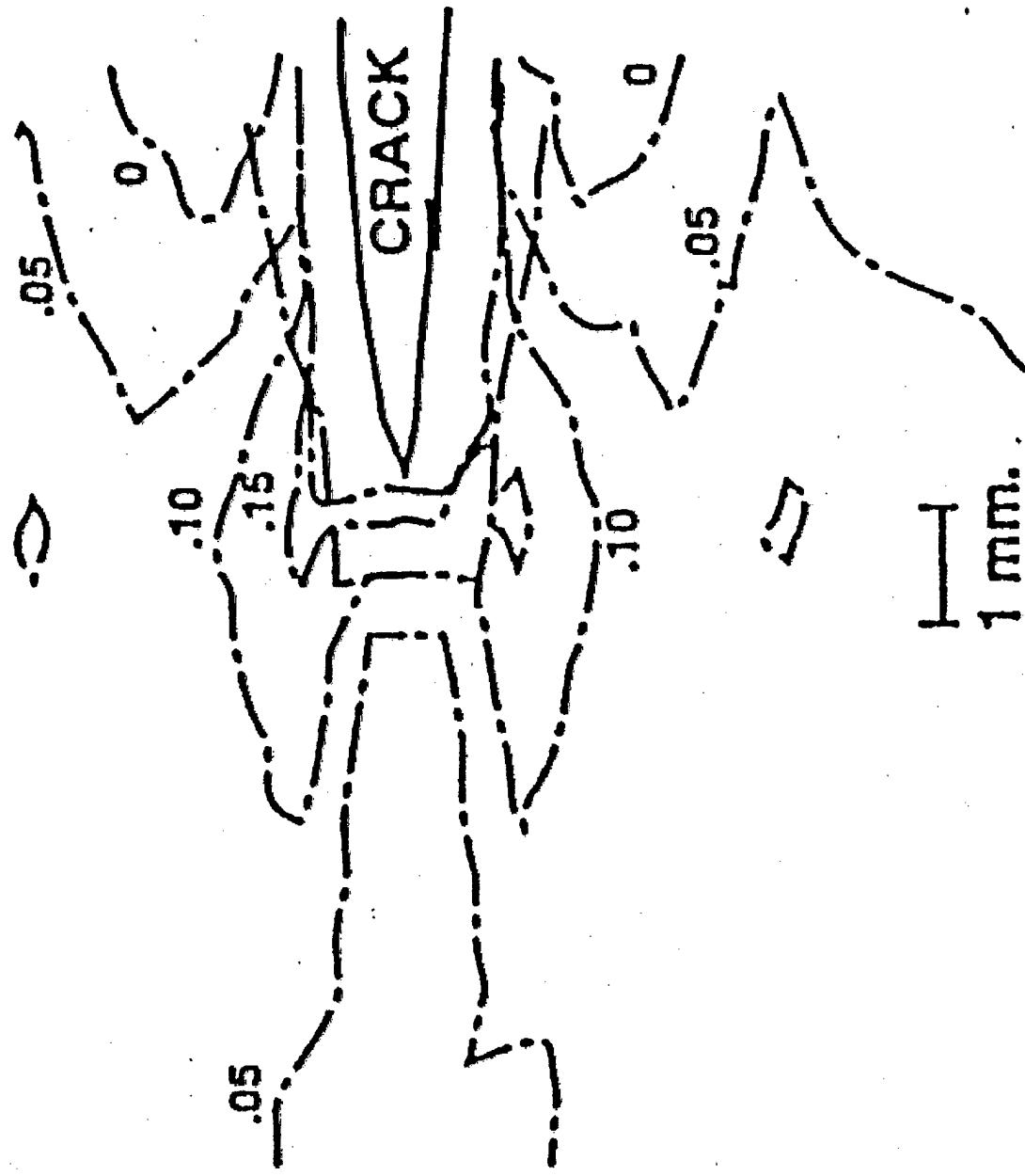
Typical Contour Plots of Normal Displacement ($T = -53.9^{\circ}\text{C}$, $t = 2.54\text{mm}$)

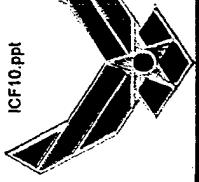


Thickness = 2.54mm

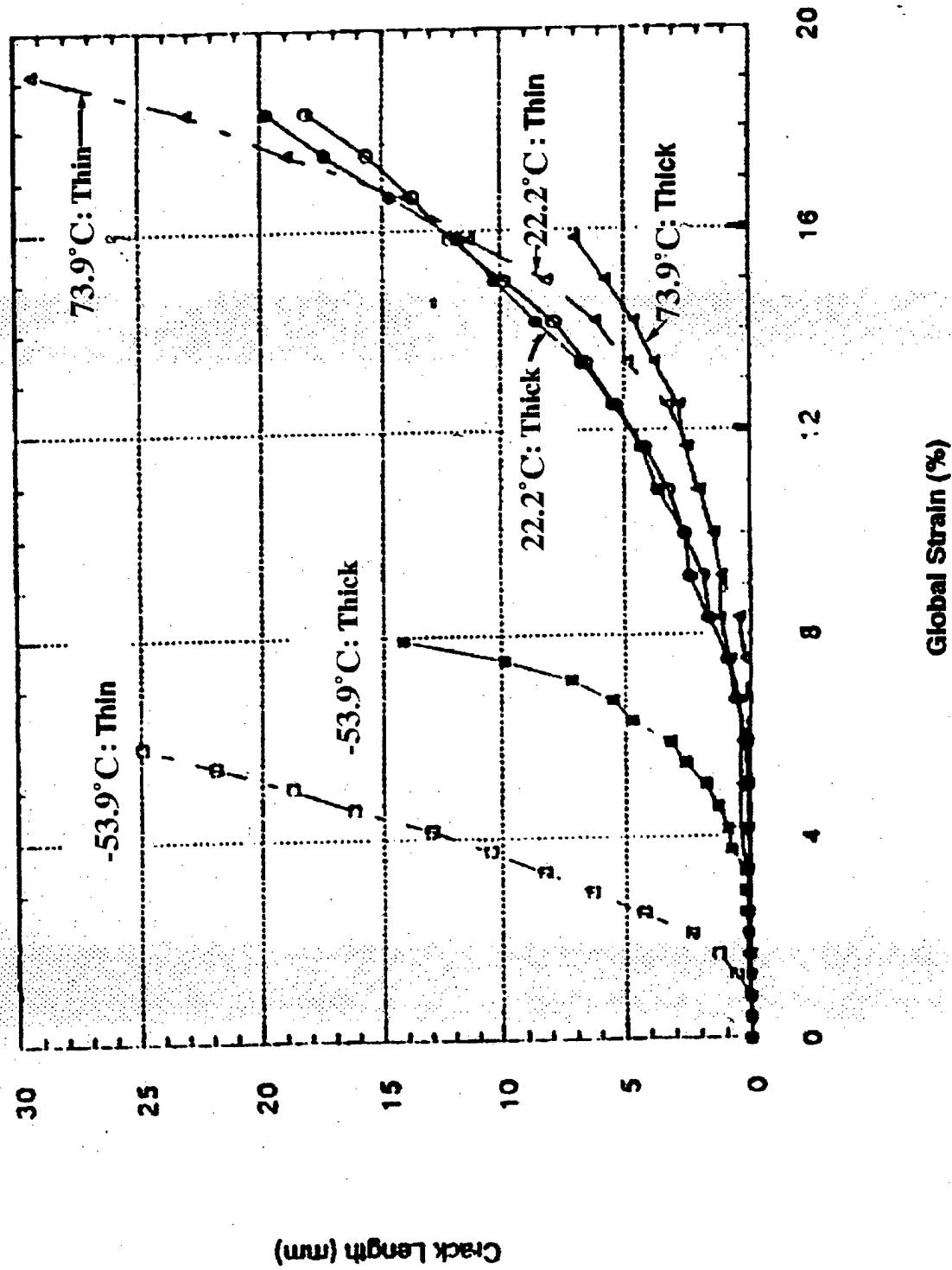


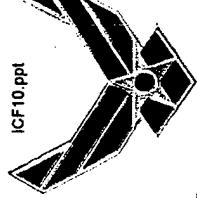
Thickness = 12.7mm



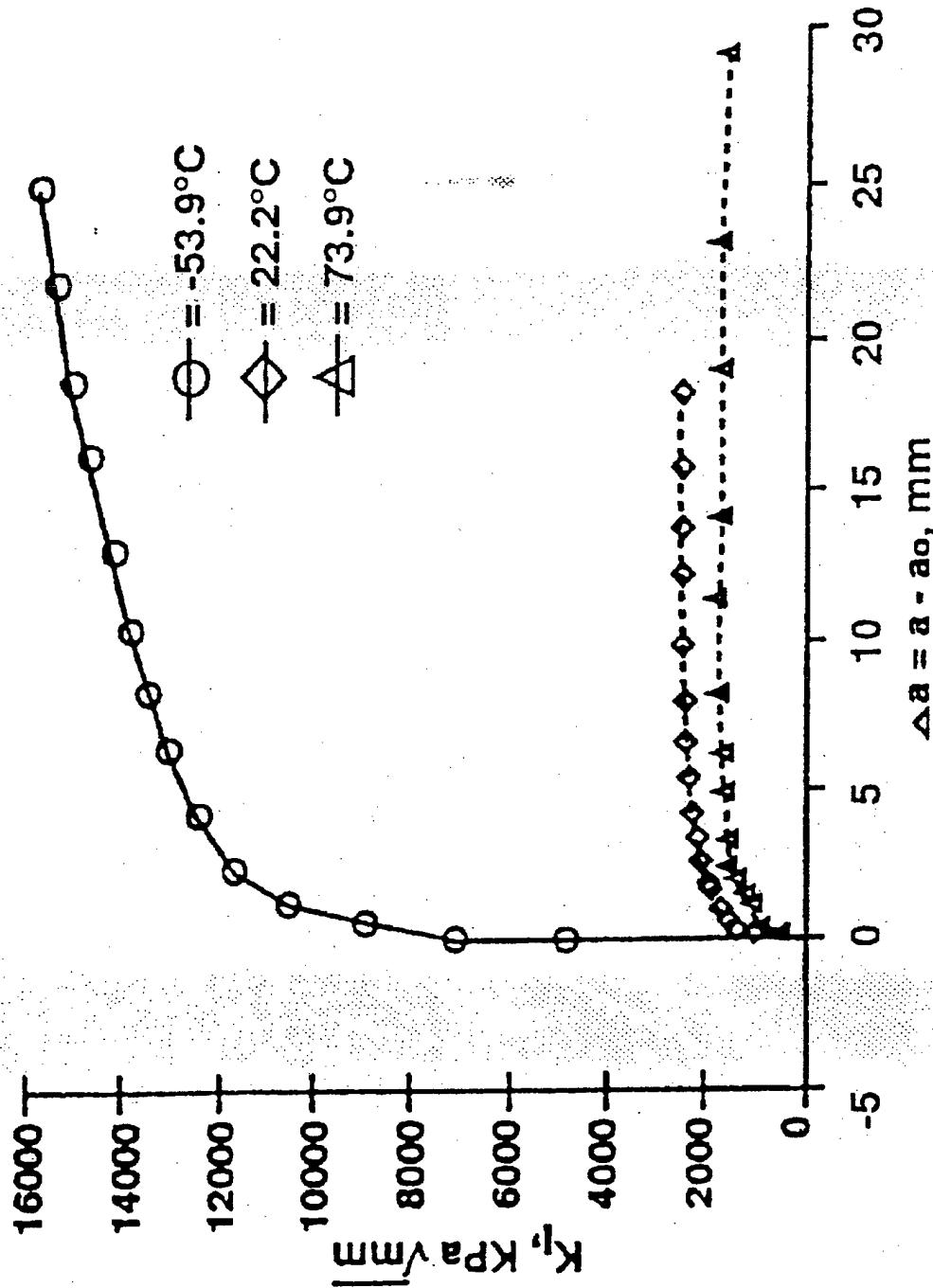


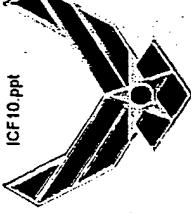
Crack Length (mm) Versus Global Strain (%)



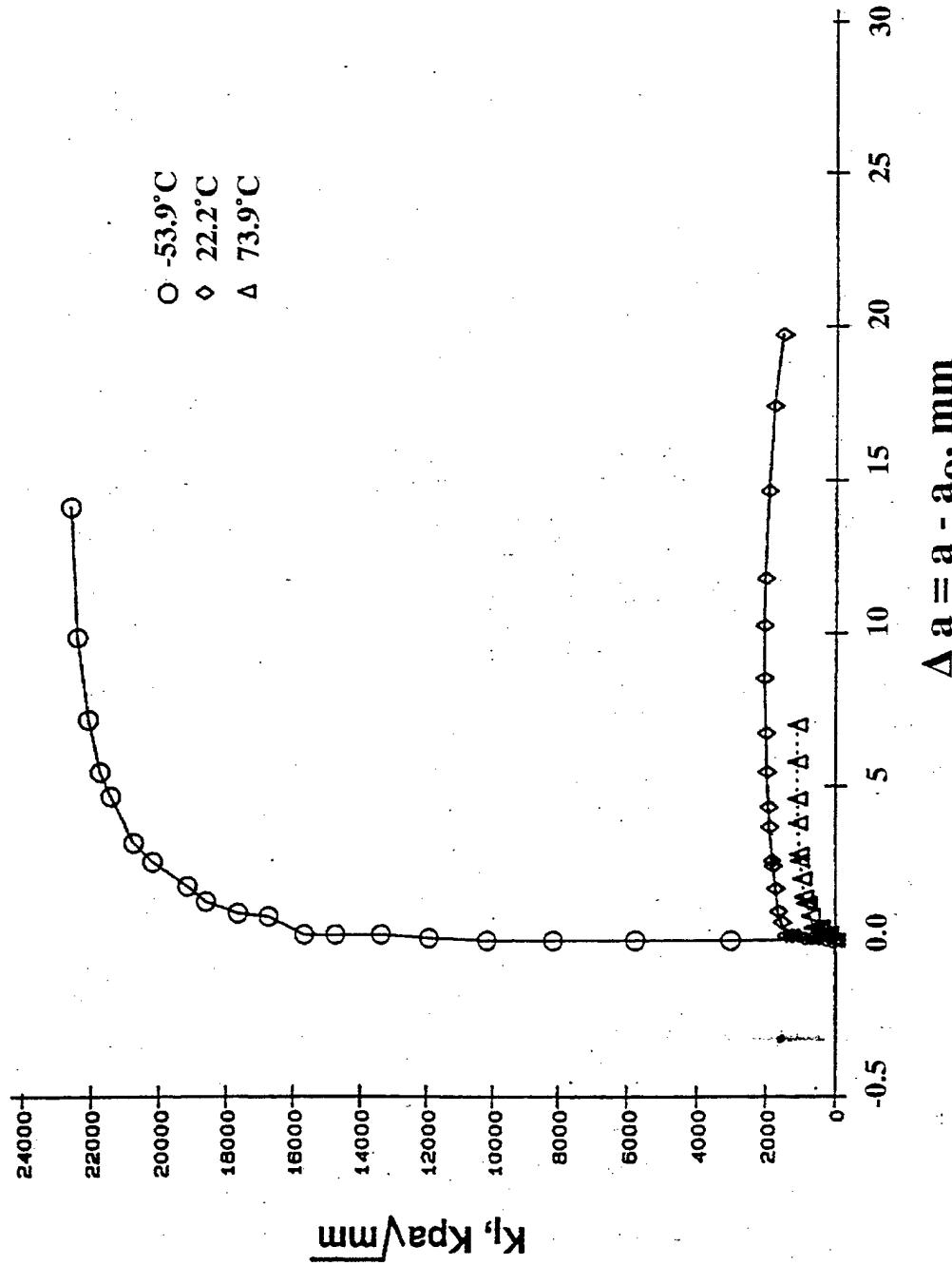


Crack Growth Resistance Curves ($t=2.54\text{mm}$)



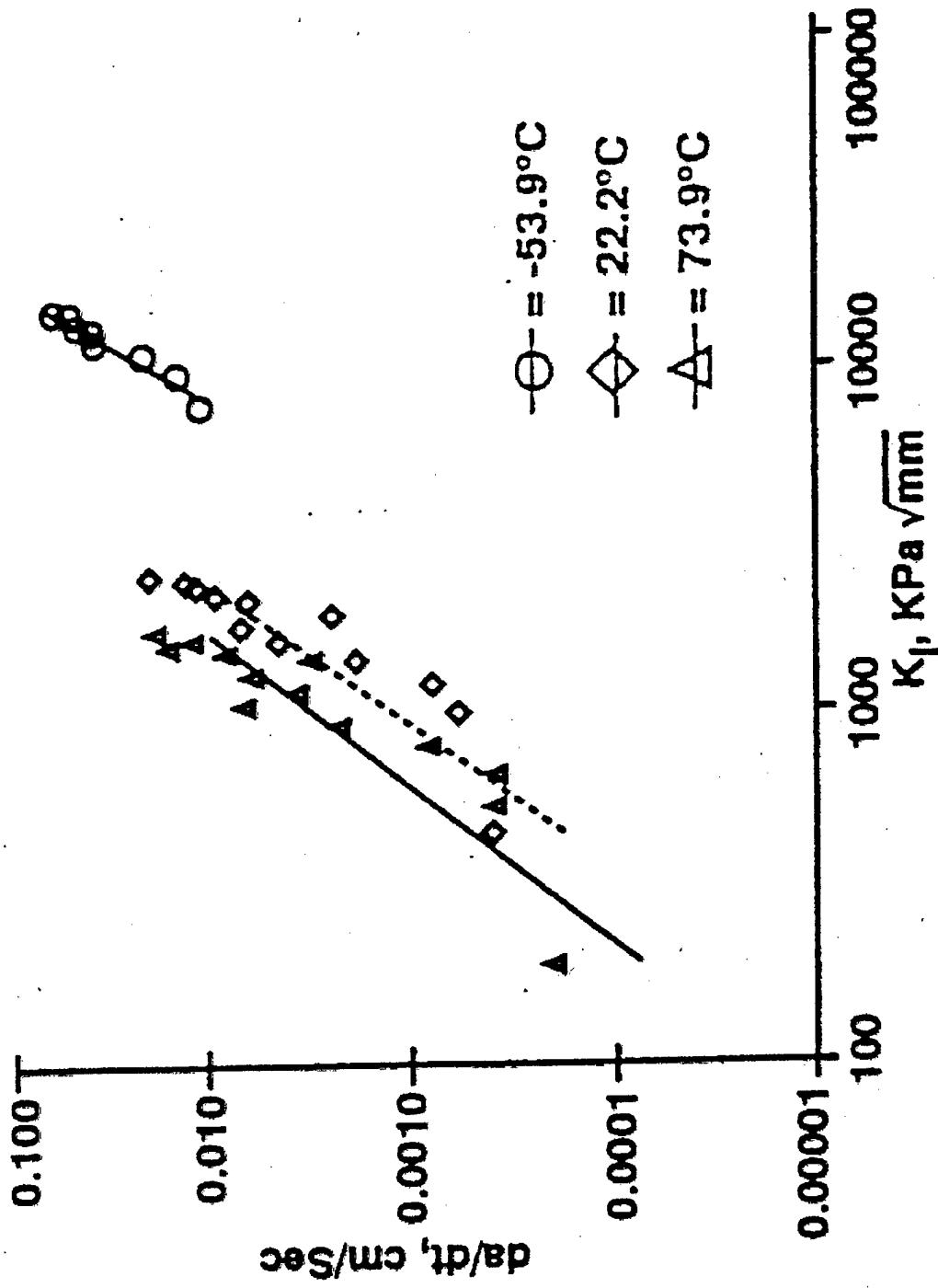
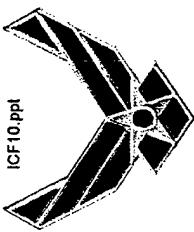


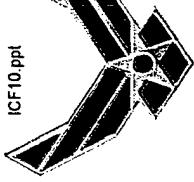
Crack Growth Resistance Curves (t=12.7mm)



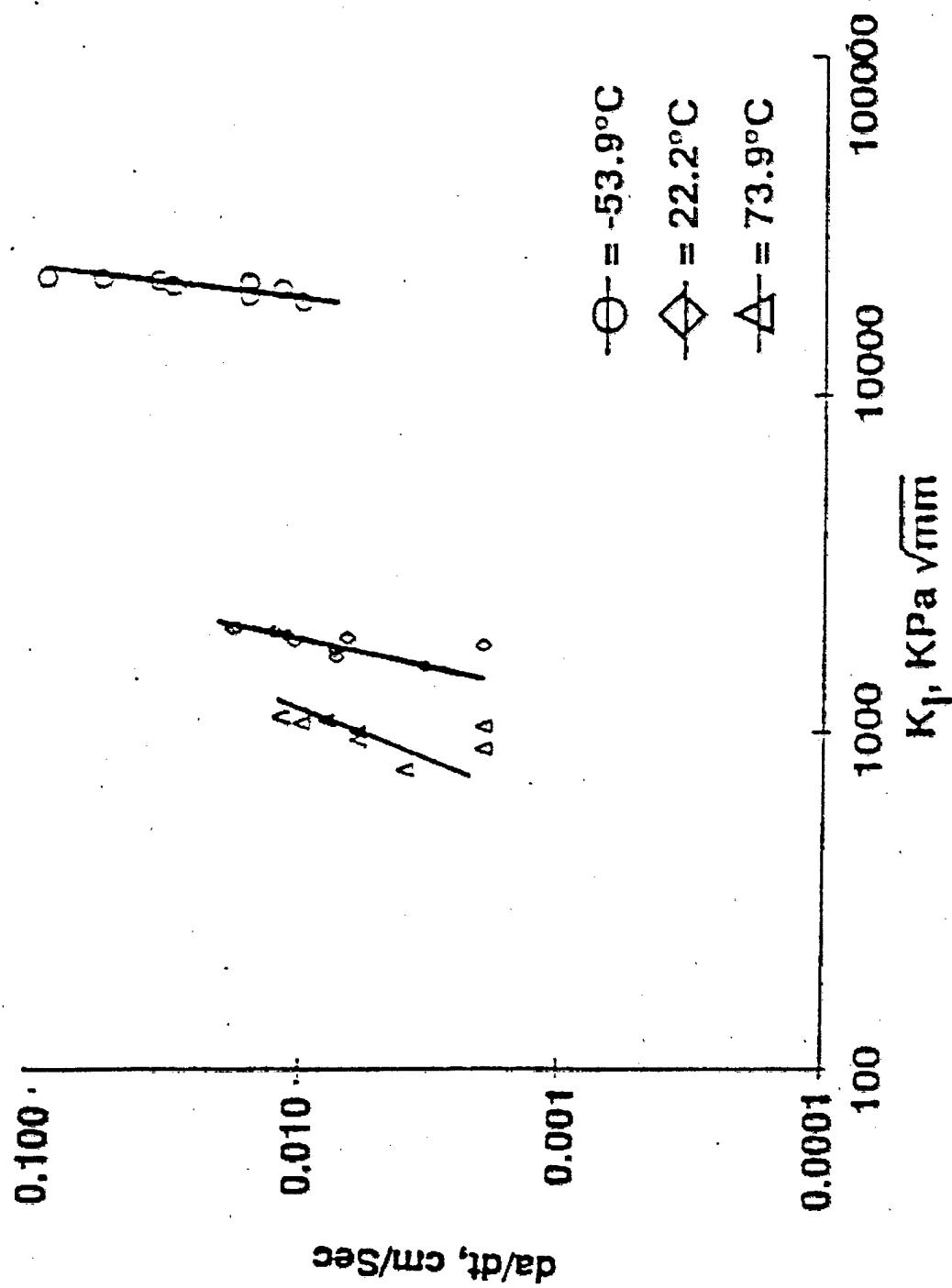
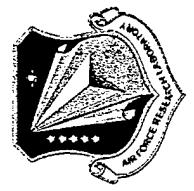


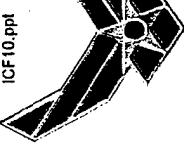
Crack Growth Rate Versus Stress Intensity factor ($t=2.54\text{mm}$)





Crack Growth Rate Versus Model I Stress Intensity factor (t=12.7mm)





Conclusions

- This is an "observation". Can you draw some conclusion from my observation?*
- The crack growth behavior at -53.9°C is significantly different from that at 22.2°C and 73.9°C .
 - The increase in specimen thickness alters the local strain fields but the iso-strain contours are of the same general form.
 - A power law relationship exists between the Mode I stress intensity factor and the crack growth rate.